

STEAM Concepts Integrated into the School and Home Environment

*Dave Tomko and Students, Sharon City School District
SPAC Title I Conference
July 19, 2016*

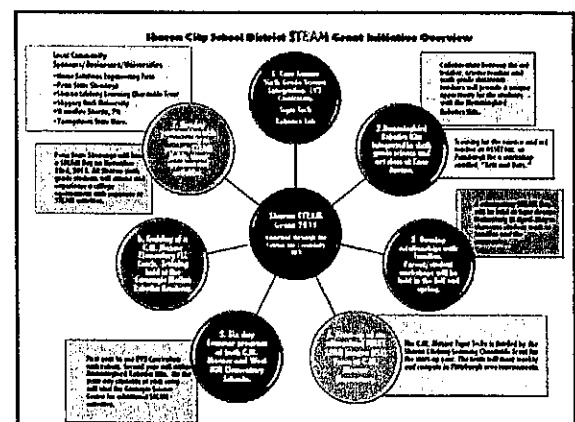
STEAM Integration

Goals:

- ✓ STEAM integration at Sharon City School District
- ✓ Hands-on time with LEGO Mindstorm EV3 Robot
- ✓ FIRST LEGO League
- ✓ Hands-on time with Hummingbird Robot
- ✓ Integrate STEAM concepts after today

Sharon City School District STEAM Grant (Science, Technology, Engineering, Art, and Math)

- Grant funded by the Allegheny Intermediate Unit's Center for Creativity in Pittsburgh and several corporate sponsors:
 - ✓ The Chevron Corporation
 - ✓ The Claude Worthington Benedum Foundation
 - ✓ The Grable Foundation
- Local Funding:
 - ✓ Sharon LifeLong Learning Charitable Trust



Sharon City School District STEAM Grant (Science, Technology, Engineering, Art, and Math)

The purpose is to foster interest and develop science, technology, engineering, mathematics, and art skills in middle school students through the use of robotics.

- Between elementary and high school, interest in STEM subjects decline significantly.
- Hands-on technology and curriculum engages and motivates students to learn STEM/STEAM concepts.
- Society requires students to be ready with real-world knowledge and 21st century skills in order to be successful.
- From 2010 – 2020 STEAM/STEM jobs will grow by 14% - US Dept. of Education

Pittsburgh - "Roboburgh"

- STEM fields are growing faster than other fields, especially in Pittsburgh. Pittsburgh tech /education jobs account for 80% of high paying jobs.

Major Universities:

- Carnegie Mellon University- The Robotics Institute
- University of Pittsburgh
- Duquesne University

Companies

- Carnegie Robotics
- National Robotics Engineering Center
- RedZone Robotics
- Blue Belt Technologies
- Discovery Robotics
- Disney and GM partnerships at Carnegie Mellon

What is a robot?

[What is a robot? Video](#)

A robot is...

A machine capable of carrying out a complex series of actions automatically, especially one programmable by a computer.

A robot has the following characteristics:

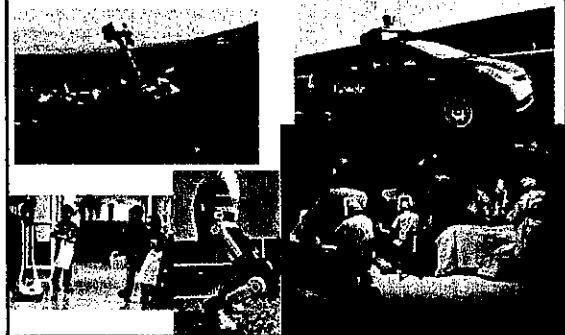
- ✓ Ability to SENSE: detect environment around it
- ✓ Ability to THINK: have intelligence
- ✓ Ability to ACT: move
- ✓ Energy

Entertainment- Jetsons, Star Wars, Big Hero 6

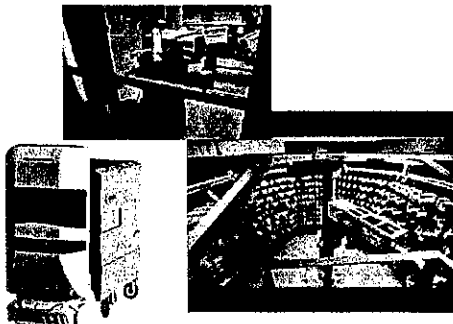


[Robot Movie Clip](#)

Robots Used in Everyday Life



Medical Field Robots

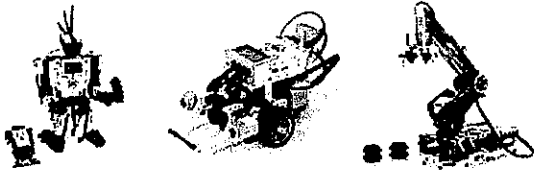


Manufacturing Robots



Robotics in the Classroom and/or Home Environment

LEGO EV3 MINDSTORM ROBOT



EV3 Mindstorms-Robotics in the Classroom

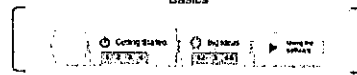


EV3 Curriculum- Carnegie Mellon Robotics Academy

Introduction to Programming
LEGO® MINDSTORMS® EV3



Basics



Behaviors

Movement

EV3 Curriculum- Carnegie Mellon Robotics Academy

The curriculum focuses on understanding the functions of the robot:

- movement (forward and turning)
- sensor usage (light, touch, ultrasonic, gyro)
- decisions (such as loops, switches, switch-loops, line followers)
- data hubs - \$

EV3 Mindstorms Demonstration

- Detect Blue Line Test
- Distance Sensor Test
- Traffic Light Test

EV3 Curriculum- Carnegie Mellon Robotics Academy

There are ten chapters/projects that are included in the curriculum. A few include...

- ✓ A problem that a real-life robot solves.
- ✓ A LEGO-scale version of the problem for students to solve with their robots.
- ✓ Step-by-step guided video instruction that introduces key lessons and concepts by building simple programs that progress toward the challenge task.

EV3 Curriculum- Carnegie Mellon Robotics Academy

- ✓ Built-in questions that give students instant feedback on whether they understood each step correctly, to aid in reflection and self-pacing.
- ✓ Reflection questions to assess the depth of student understanding while challenging them to apply higher-order problem-solving and writing tasks. \$
- ✓ A culminating challenge at the end of each chapter for the LEGO robot.

EV3 Mindstorms-Robotics in the Classroom

- 9 Week Unit
- Follows PA Academic Standards in Science - Technology and Engineering Education Strand
 - Discovering how parts relate to the whole
 - How STEM fields create new technologies
 - How technologies are developed on need
 - Use design for a product and test it
 - How models communicate and test design processes
 - Apply design processes to solve problems
 - Use computers to apply information
 - Design and use instruments to evaluate data
- Incorporates math and reading standards

Engineering Design Process

Student Name: _____ Date: _____

Project Name: _____

1. Define the problem: What are you trying to solve? (Write the problem.)

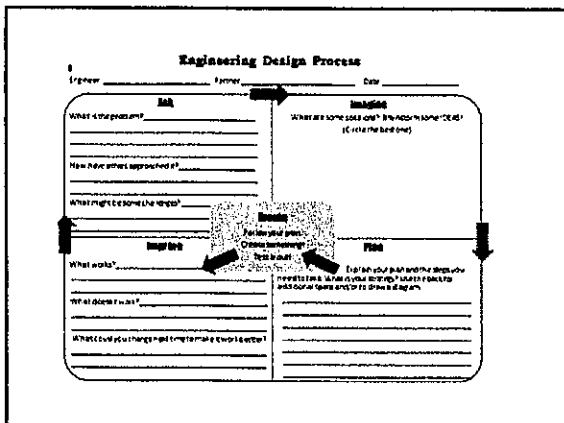
2. Brainstorm ideas: What are some possible solutions? (List at least 3 ideas.)

3. Choose a solution: Which idea do you think is the best? Why?

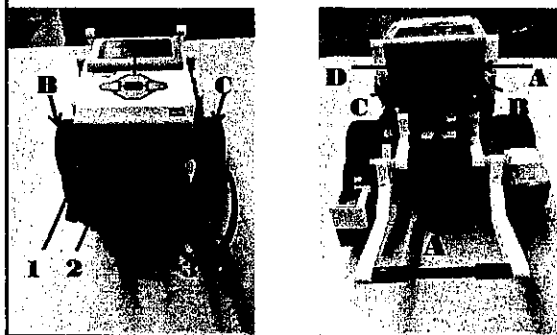
4. Build a prototype: How will you build your solution? (Draw a diagram.)

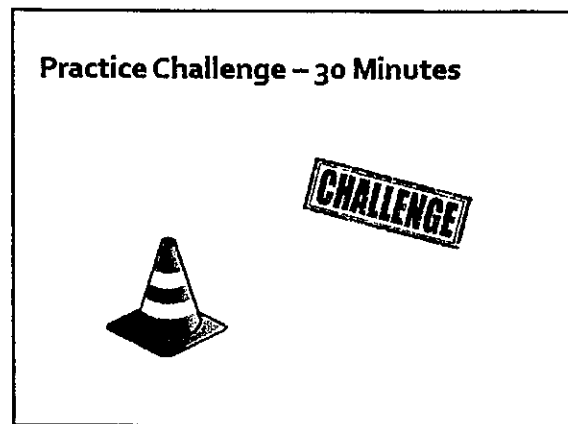
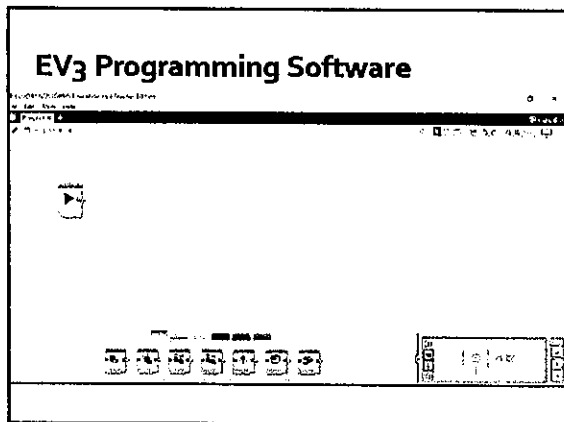
5. Test and evaluate: How well does your solution work? (Describe your results.)

6. Improve your design: How can you make your solution better? (Describe your improvements.)



EV3 Mindstorms Hardware

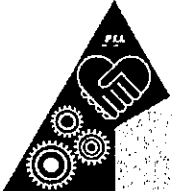





What is FIRST LEGO LEAGUE?

Competitive Robotics Team with a Three Part Focus:

1. Robotics
2. Research
3. Teamwork

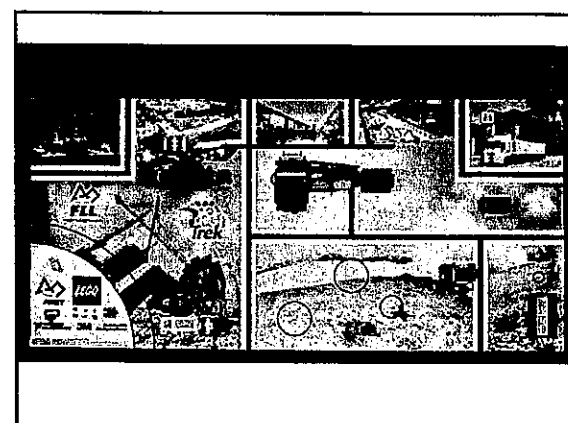


- Up to 50 members on a team
- For 9-14 year old children
- Compete regionally



ROBOTICS

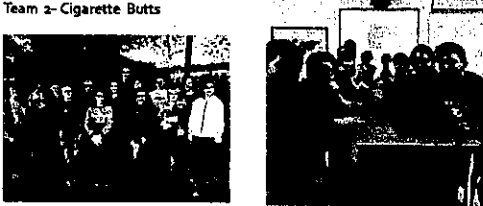
- 2015-2016 Theme: **WORLD CLASS (Learning)**
- 14 missions on the robotics table
- Robot must run autonomously for a 2.5 minute time frame
- Must design robot and attachments to complete missions
- Points are associated with each mission



Research Presentation

1. Identify a piece of trash


Team 1- Paper
Team 2- Cigarette Butts



Brainstorming session!


Research Presentation

2. Create an innovative solution to reuse the trash


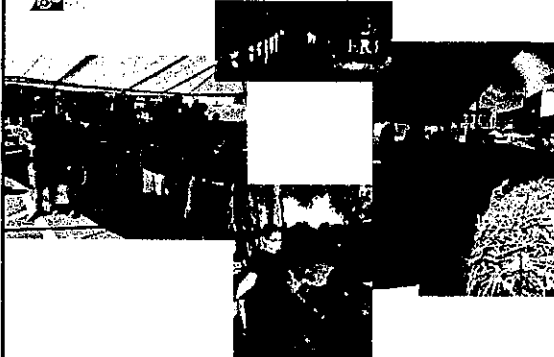


Research Presentation

3. Present to the community




TEAMWORK: WATERFIRE, SHARON, PA

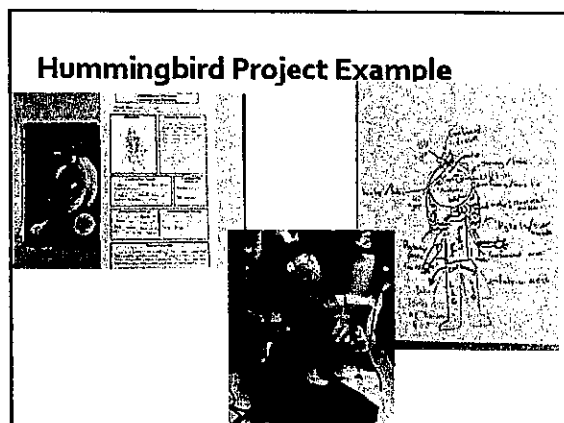
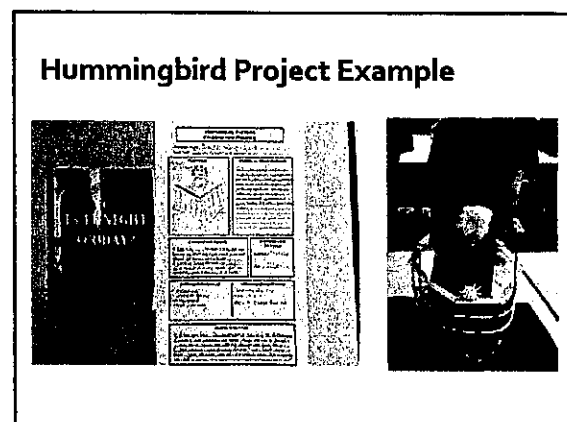
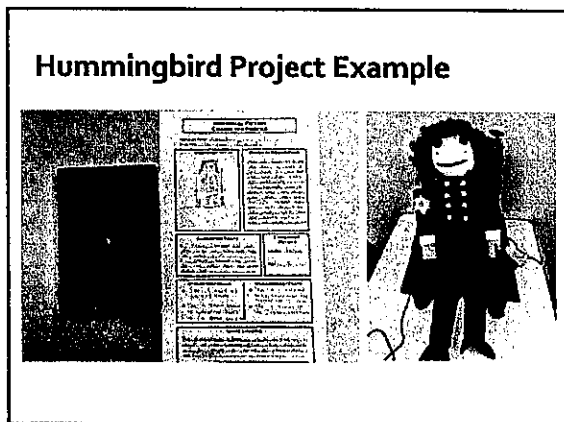
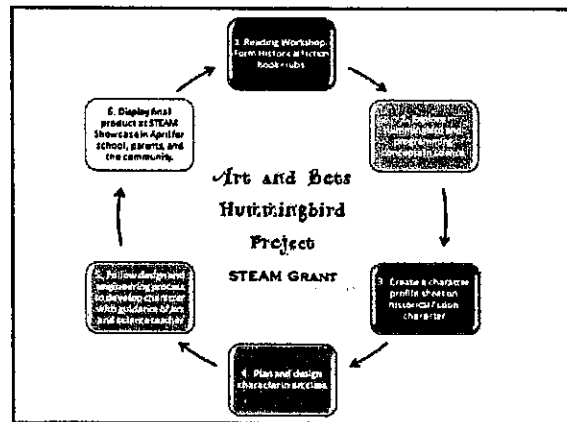


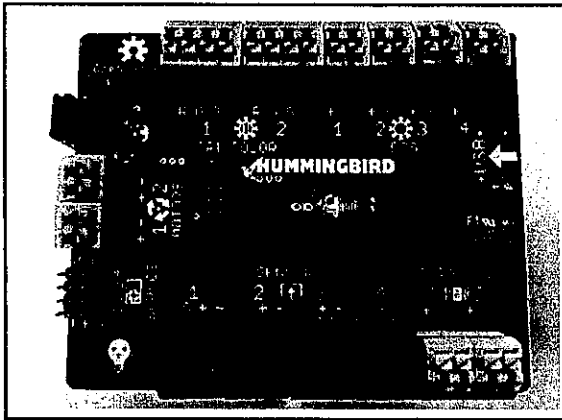
Break

What is a Hummingbird Robot?

- The Hummingbird allows students to create and program robots built out of electronic and craft materials.
- Engages students and teachers in programming, creativity, and robotics.
- Made by Birdbrain Technologies



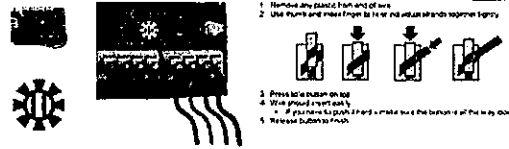




Outputs- Motors/Lights

- Color LED's
- Tri-Color LED's
- Servo Motor- 180 degrees, limited rotation/elbow
- Motor- 360 degrees, full rotation/fan
- Vibration Motor

USING A TRI-COLOR LED



Inputs- Sensors

- Light Sensor
- Temperature Sensor
- Distance Sensor
- Sound Sensor

USING A SENSOR



Software

- CREATE LAB- Visual Programmer
- SCRATCH
- SNAP
- ARDUINO

<http://www.hummingbirdkit.com/software>

Engineering Design Process

Step 1 and 2 : Ask and Imagine

What do you want your robot to look like?

What do you want your robot to do?

Where did you find your idea for your robot?

Step 3: Plan

What materials will you need to plan out your robot?

Sketch out your robot below or on a separate piece of paper.

Step 4: Design

Step 5: Improvements

What worked? What didn't work? What could be done to improve the robot?

Hummingbird Practice

Hummingbird Challenge

GOAL:

1. Turn on green light- GREEN ON
2. Turn motor 180 degrees right- MOTOR 180 RIGHT
3. Turn on red light- RED ON
4. Turn motor 90 degrees to left- MOTOR...
5. Turn light to blue-
6. Turn motor to go to left-
7. Turn light off -

CHALLENGE- Add in a vibration motor and a sound of your choice

What's next?

- Integrate STEAM Concepts after today
✓ Information/costsheet in folder

Questions?

Contact:
Dave Tomko
dave_tomko@sharonsd.org

Resources

BrdBrainTechnologies
<http://www.hummingbirdkit.com/>

Carnegie Mellon Robotics Academy
<https://www.education.rec.mcm.edu/centers/robotics/review>
<http://education.rec.mcm.edu/centers/robotics/faq/faq-robotics-101-2014-2015.pdf>

FIRST- FIRST LEGO League
<http://www.firstleagues.org/robotics/>

Huffington Post
<http://www.huffpost.com/entry/the-importance-of-stem-1-b-048888.html>

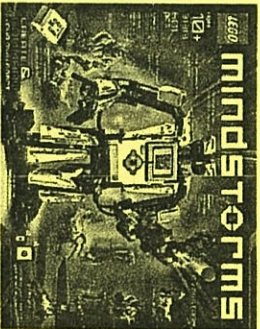
LEGO Education
https://www.youtube.com/watch?v=h2N_D0bmbtc

Worcester Polytechnic Institute
https://www.youtube.com/watch?v=h_QDuYucUw

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LEGO MINDSTORM EV3 ROBOT



Retail LEGO MINDSTORM EV3 Set

Retail Website: www.shop.lego.com

Full Website Address: <http://shop.lego.com/en-US/LEGO-MINDSTORMS-EV3-313137p=313138&track=checkprice>

Item: 31313 Ages: 10+ Price \$349.99



LEGO MINDSTORMS Education EV3 Core Set

Education Website: <https://education.lego.com/en-us>

Full Website Address: <https://education.lego.com/en-us/products/lego-mindstorms-education-ev3-core-set-/5003400>

Item: 5003400 Price \$379.95

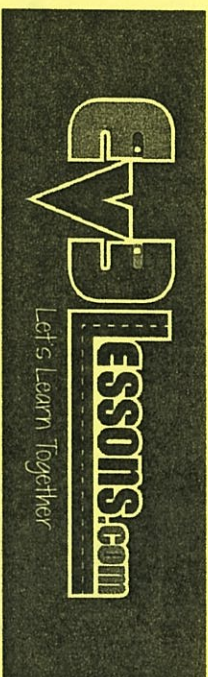
EV3 CURRICULUM



Website:

<http://www.education.rec.nyu.edu/content/lego/ev3/preview/>

Price: Free *Must register with an e-mail*



Website: <http://ev3lessons.com/>

Price: Free

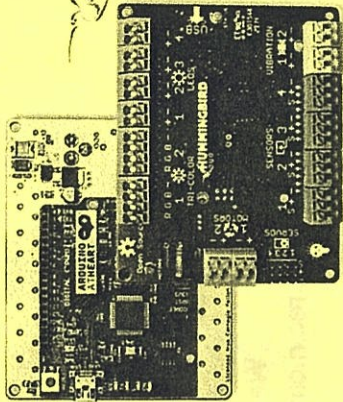
FIRST LEGO LEAGUE

Website: <http://www.firstinspires.org/robotics/fll>

Ages: 9-14



HUMMINGBIRD ROBOTICS KIT



THE NEXT GENERATION OF HUMMINGBIRD
**HUMMINGBIRD
DUO**

- Fun and educational for 4th graders and college students alike!
- With custom fabricated and standard's modules
- Integrates with Arduino shields and many third-party electronics
- Program with our step-by-step software, Scratch, Arduino, & more
- Dozens of tutorials and classroom examples available

Website: <http://www.hummingbirdkit.com/>

Price: varies with kits ranging from \$159.00 to \$269.00

SOFTWARE

Website: <http://www.hummingbirdkit.com/learning/software>

Price: Free

TRAINING/TUTORIALS

Website: <http://www.hummingbirdkit.com/teaching/training/virtual-workshop>

Website: <http://www.hummingbirdkit.com/learning/tutorials>

Price: Free

